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Ph.D. Student, Quantitative Biosciences in
Biological Sciences Second Year ARCS
Scholar Chambers/Jones Award

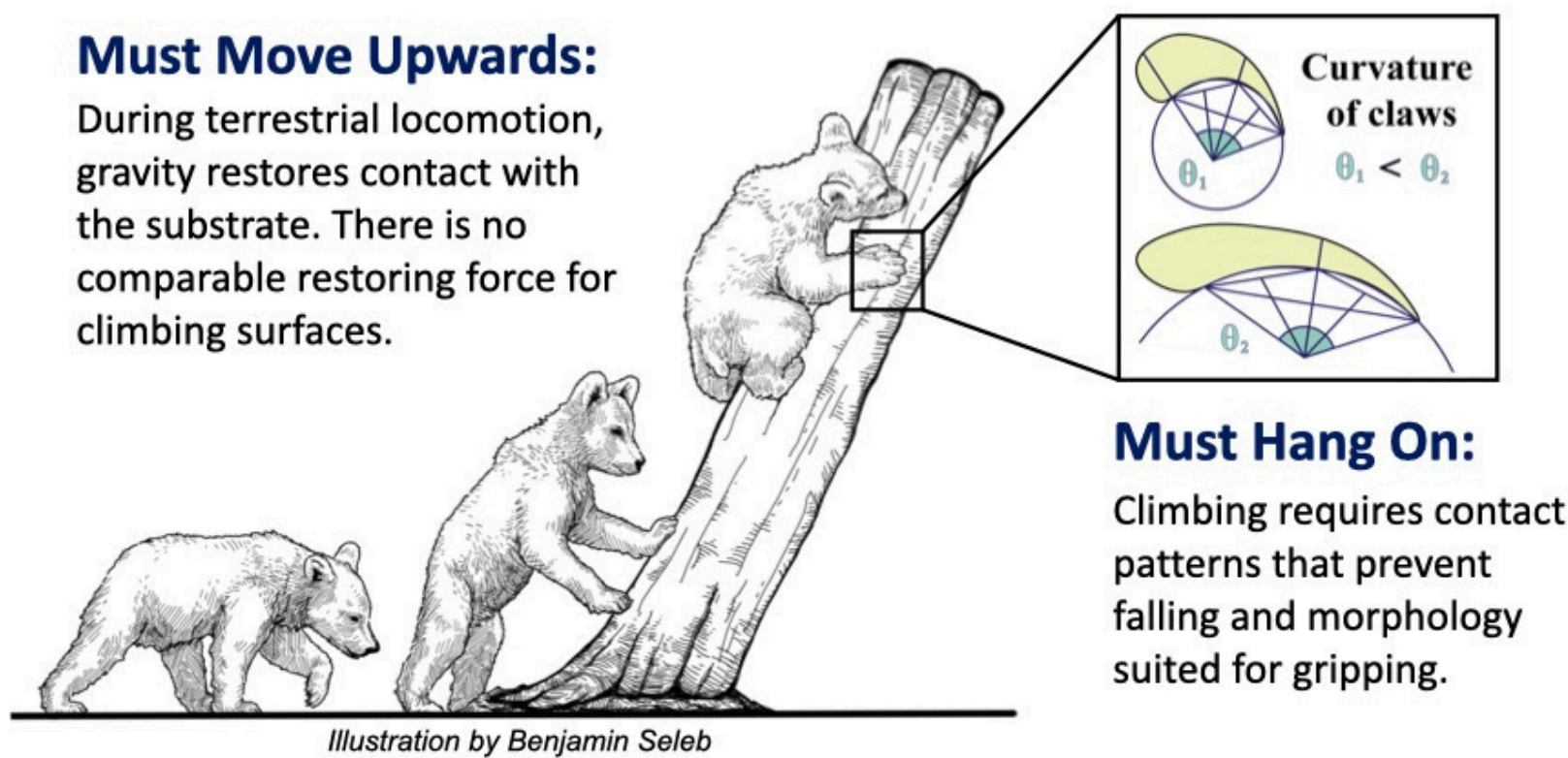


Mammalian climbing gaits and their influential criteria

Climbing incurs different locomotor constraints

Must Move Upwards:

During terrestrial locomotion, gravity restores contact with the substrate. There is no comparable restoring force for climbing surfaces.



Must Hang On:

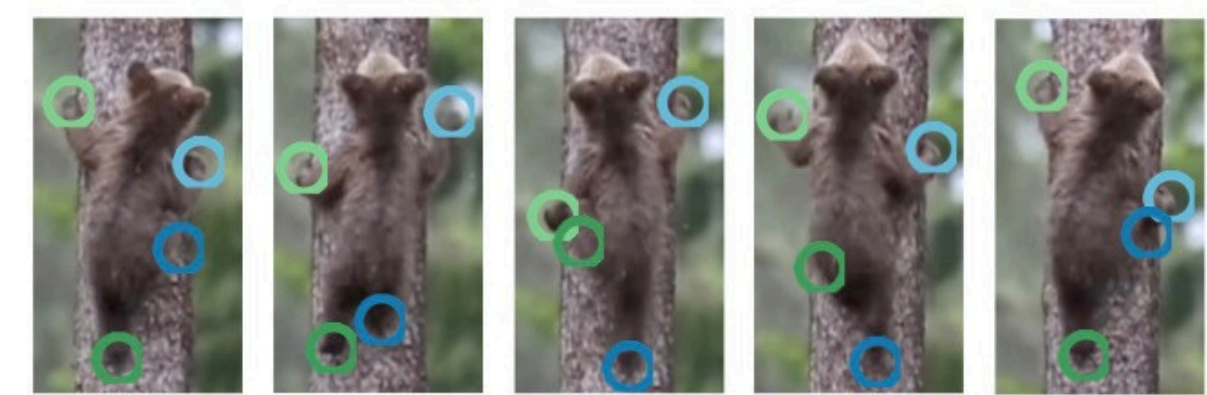
Climbing requires contact patterns that prevent falling and morphology suited for gripping.

Illustration by Benjamin Seib

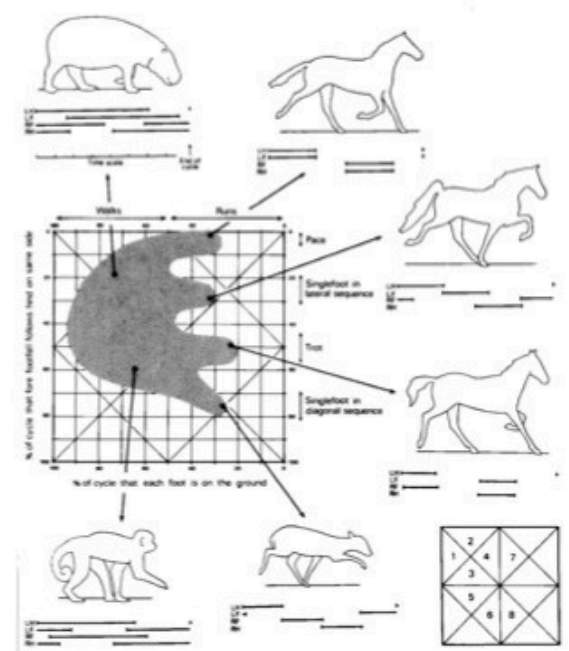
How do climbing gaits compare to terrestrial ones?

Hypothesis:

Due to biomechanical constraints of climbing, mammalian climbing gaits will fall within and occupy a smaller subspace of known terrestrial gaits.



Hildebrand define a regime for over 1200 mammalian terrestrial gaits using two criteria



Hildebrand, 1989 (adapted from Hildebrand, 1985)

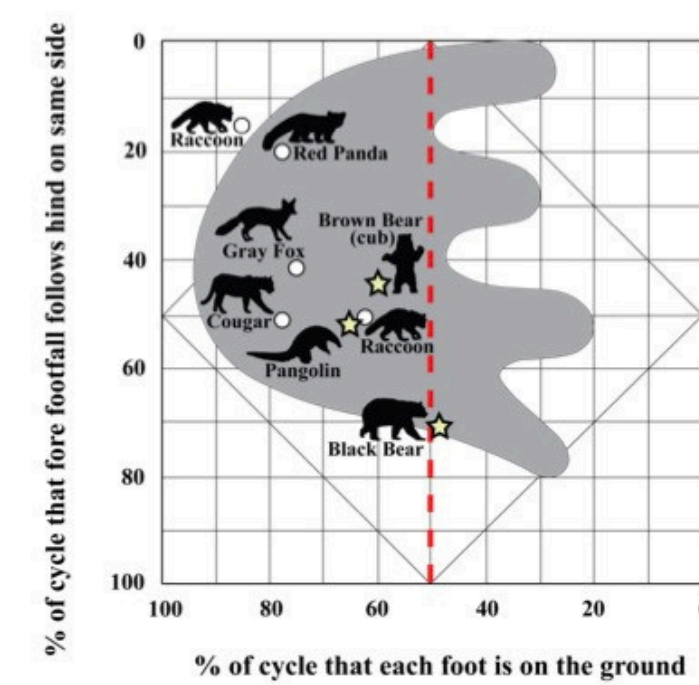
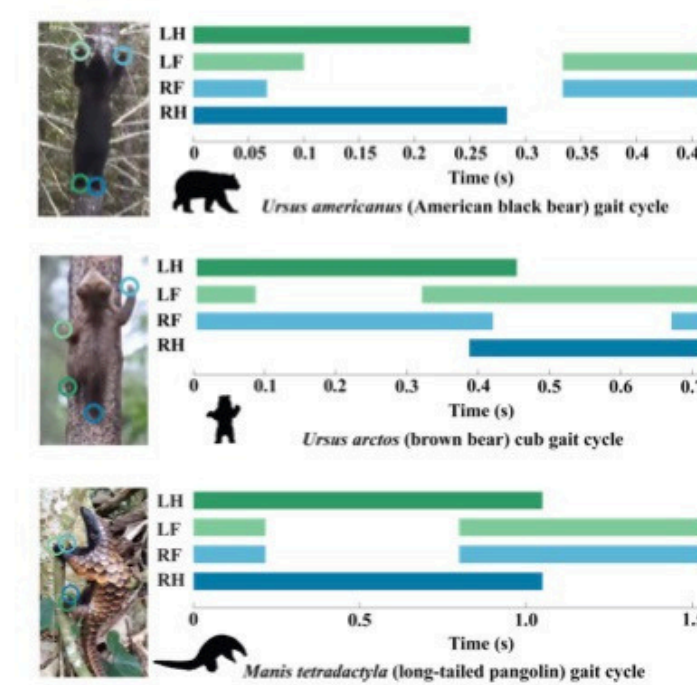
Duty Cycle:

The percentage of a cycle an individual foot is in contact with the ground

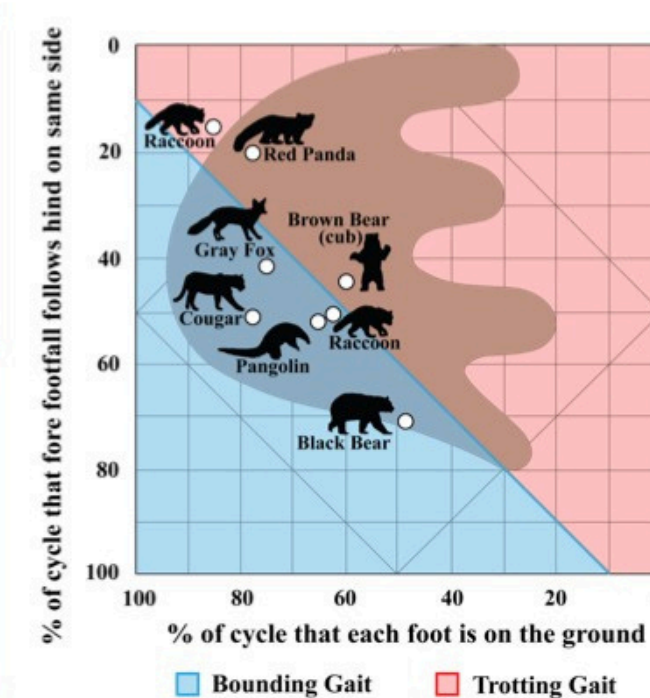
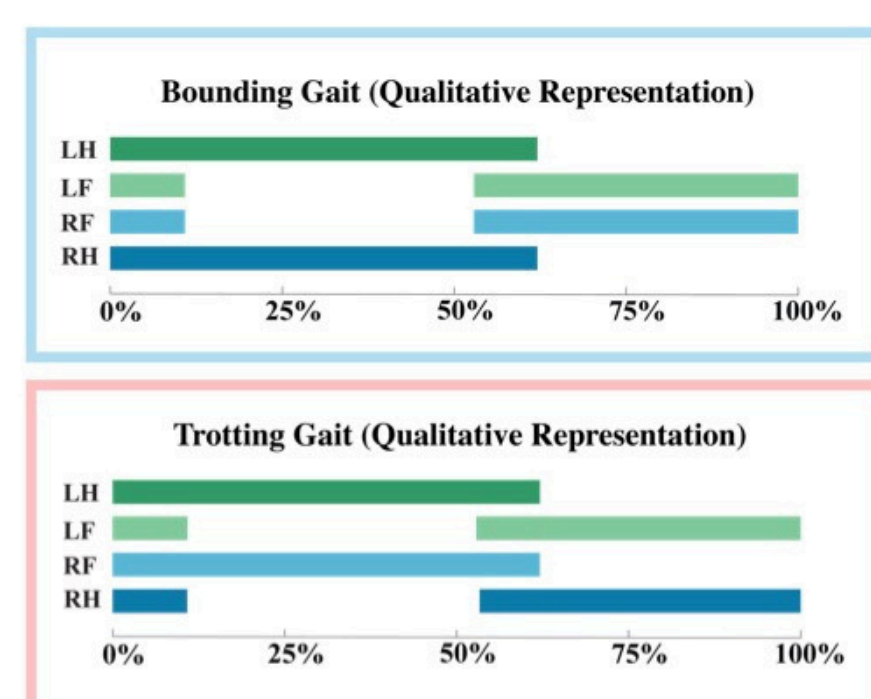
Same-Side Limb Phase:

The percentage of a cycle between the same-side hind and fore footfalls

All but one of the analyzed gaits fall within Hildebrand's plot and within a smaller subspace



Two distinct types of gaits emerge: a bound and a trot



Future work will examine energetics and scaling relationships to determine climbing strategies



Scan this QR code to watch the pangolin, adult black bear, and brown bear cub climbing videos

Why is a single bounding cycle of the pangolin three times longer than that of the black bear?

Why does a brown bear cub use a trotting gait while an adult black bear climbs with a bounding gait?

Thank you to my co-advisors Dr. Young-Hui Chang and Dr. David Hu for supervising my work in the Comparative Neuromechanics Laboratory and Hu Laboratory for Biocomotion. Thank you to Zoo Atlanta keepers and staff for their time scheduling trials and placing food in-habitat to encourage climbing. I extend gratitude to the National Science Foundation for financial support through the Graduate Research Fellowship Program.

Scholar Awards Celebration
November 15, 2023



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